A PAPER

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PROPRIETY AND NECESSITY OF COMPULSORY VACCINATION.

BY

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A PAPER ON THE PROPRIETY AND NECESSITY OF COMPULSORY VACCINATION.

THE reflection is not flattering to man's self-love that disease, or eminent susceptibility to it, is the almost invariable concomitant of his physical existence. But as an offset to this infirmity he is endowed with intelligence and reason capable, in a great measure, of relieving actual suffering, and lessening the liability to disease, by controlling the circumstances which surround him, and may thus render life a pleasure or a burden as he wills.

If it be true, as assumed, that man, by a wise forethought and the exercise of his best intelligence, can protect his health and control the ravages and mortality from specific and preventible diseases which overtake the ignorant and improvident, it is clearly a sacred duty for the custodians of the public welfare to see that the effort is made. It is eminently proper, if not the duty of physicians, who are by virtue of their profession the friends and advisers of the people in regard to their health, to inform them and their rulers of what is essential to be done, or to be left undone, to secure this end. Regulations for the preservation of the general health, we think, ought to be concerted between the legislative authorities and the medical profession, and should not only be recommendatory, but to a considerable extent compulsory in character. Fickleness is so common a weakness of human nature, that a duty which begins with the individual and extends to the public, and is left entirely to individual judgment or inclination, is in the end almost certain to be neglected, or performed in an unreliable manner. In the execution of most measures which protect and elevate the human race, the mass of mankind require to be governed and directed by positive law, or the force of an inexorable public opinion.

The assumption that the individual has the right to protect or abuse and neglect his own health at pleasure is false in morals, and, as we believe, equally in opposition to the social and statutory law. And as a numerous population is of the highest importance to the strength and welfare of a nation, it should be the anxious study of legislators to favor that end by the enactment of such laws as will best protect the health and lives of the people. It is a well-known fact in the economy of population that the conditions which most favor the multiplication of the human species are health, the enjoyment of peace, and an abundance of food; and, *per contra*, of necessity, the conditions which most seriously retard the increase of population are pestilence, war, and scarcity of food.

The Eastern nations were, from the earliest ages of historic record, visited by occasional pestilential plagues, so terribly devastating in their career as almost to depopulate whole cities and extensive districts of country. Yet historians do not hesitate to say that, vast as was the mortality from the plague, it was even exceeded by that of the smallpox. This fell destroyer and marrer of the beauty of the human form was confined to no country or climate, and spared neither sex nor age. Up to within the last hundred and fifty years it was the most frequent, the most fatal, and the most injudiciously treated of all the pestilences that have afflicted mankind. Owing to the meagre and unsatisfactory records of disease in the early ages of the world, it is now probably impossible to determine at what period smallpox first made its appearance among mankind. Doctors, equally eminent for their scholarly lore, and noted for their laborious researches into the history of diseases, entertain different views as to the antiquity of its origin. Some believe that it first manifested itself in the sixth century; others place its origin several centuries later; while not a few of the ablest scholars contend that its existence can be traced to a period anterior to the Mosaic record.

Without the time to fully investigate this part of the subject, which is but of minor importance to the question under consideration, I am nevertheless inclined to believe in the very great antiquity of smallpox—say from about that period in man's condition and habits when the employment and domestication of animals was adopted as adding to his comforts and conveniences.

There does not seem to be much doubt that variola has existed in Arabia since the sixth century, and, advancing westward, reached England about the close of the eighth, and became general throughout Europe in the twelfth. Notwithstanding the accumulated experience of practice, the medical profession during all that time had discovered neither preventive nor cure, remaining a sad spectator of its desolations, and utterly unable to afford relief. It defied alike the measures devised by civil rulers and the appliances of medical science, continuing for ages unimpeded in its work of death and disfigurement.

For more than a thousand years the only means known to mankind that gave any hope of escaping the ravages of smallpox was in flight from it, or in the institution of a rigid quarantine. These modes have been largely practised both by civilized communities and the savage races.

The step which first led the medical profession to an improvement in the mode of dealing with smallpox was the accidental discovery, by travellers, of a practice common among the country people in that part of the Turkish Empire known as the Levant. The practice was exceedingly strange, a reversal of all theories, and seemingly very unphilosophical. It was neither cure nor preventive, but the "engrafting" of the actual disease upon the patient, which experience or accident had taught them would induce a milder and safer form of the disease than when contracted casually from contagion.

It is probable that the practice of variolous inoculation was begun among unlettered people in different parts of the world, having no communication with each other, or knowledge that similar expedients had been resorted to elsewhere. When, however, attention was drawn in England, by Lady Mary Wortley Montague, to the "Turkish mode of engrafting the smallpox," and the history and antiquity of the practice had been investigated, it was found to have been in vogue, time out of mind, in China, Hindostan, Africa, and, strangely enough, even in England, among the highland Welsh.

Necessity, guided by observation, rather than devotion to any theory, led to this discovery by the people, as no satisfactory reason has yet been given why the induced disease should prove milder than the same disease taken casually. And yet such is the undoubted fact. The early chroniclers of inoculation announced it to the profession and the public with the most extravagant eulogies of its safety and certainty in obtaining a mild development of variola, and which always gave perfect security against further attacks.

The practice, notwithstanding these facts were in the main conceded to be true, met with the most violent opposition from a few medical men and theologians, on the ground that it was sinful to subject any person to sickness, however laudable the intent might be, and insulting to Divine Providence to seek to escape from a disease sent by Him. This practice—the first great step in the protection of the human family from the terrors and havoc of smallpox—after many years, and much effort on the part of the profession, became popular with the people, both in Europe and America, and has been the means of saving millions of lives.

The percentage of deaths from inoculation, even in the infancy of the practice, was never greater than one in fifty, and through the improvements suggested by experience, soon ceased to be greater than one in five or six hundred. These proportions presented a great contrast to that observed in the casual disease, where the deaths remain steadily at one in every five or six attacked. Important and efficient as was this measure in the preservation of life, yet it was possessed of one insurmountable objection, which was that it kept alive the seeds of variolous contagion, and while it saved life with one hand, with the other it distributed an infection dangerous to all who did not flee from its sphere of action, or avail themselves of the same mode of protection. The practice of inoculation began in 1721 in Europe and America, and continued to grow in favor, and retained the confidence of the public and the profession until the close of the eighteenth century, when it was superseded by Jenner's immeasurably important discovery of vaccination.

I will not encroach upon the space allotted to me in recounting the steps which led Jenner to the discovery of the prophylactic power of the cowpox in preventing variola, as they are faithfully recorded in nearly all the medical text-books, but will proceed to the consideration of the best mode of securing the benefit of this protection to every individual in society. The discovery, however, was the result of duly weighing the traditions of the people, and prudently testing their value. He published the result of his experimental cases in June, 1798, under the modest title of "*An Inquiry into the Cause and Effects of the Cowpox.*"

At an early period of his experiments, Jenner looked upon the cowpox as a new disease, originating in the cow; but he soon saw cause to change his opinion in this particular, and ever after looked upon it as the smallpox modified in passing through the cow. Others took up the idea which he had abandoned, and maintained that it was in reality a new disease, and acted as an antidote to variola in destroying or changing the variolous elements found in the system during its development and course.

The variolous inoculations made by Jenner to test the completeness of the protection afforded from smallpox through the constitutional impression made by the cowpox taken casually, and also upon those in whom it had been induced by vaccination, warranted him, he thought, in concluding that its prophylactic powers were perfect and permanent. He therefore recommended the practice of "variola vaccina" to the profession, as a substitute for variolous inoculation, chiefly because the former is unattended with suffering or danger, and is applicable to all ages and conditions of life, and gives an equal protection with the latter against the casual smallpox.

A violent and persistent opposition to the practice was immediately inaugurated by a few medical men, on the most whimsical grounds, one of which was, that it being a bestial disease, would, if adopted, prove more disastrous to the human family than the smallpox had ever done, by developing new diseases. These ungenerous and bigoted opponents of the new measure were unable long to prevent or retard the operation of the practice of vaccination, as the certainty of escaping a tedious confinement, along with the danger and suffering consequent upon inoculation, was an argument too powerful for any merely theoretical opposition. The different European governments, soon after the announcement of the discovery, instituted learned commissions to investigate the facts and the prophylactic powers of vaccina. The reports from these commissions fully sustained all that Jenner claimed for his discovery.

Dr. Jenner early declared his opinion in regard to the prophylactic properties of the cowpox to be that they were governed by the same law as smallpox, both being equally protective, but neither being absolutely so. However, as the practice became more general, and received the indorsement of the whole profession, he became more sanguine, and declared his conviction that the prophylaxis remained complete during the life of the individual.

But, considering everything, the author of this discovery was singularly fortunate in the general correctness of his observations and deductions as to the source of the virus, and the best mode of propagating the true disease. Experiments corroborative of his theory were soon made with matter obtained directly from the heel of the horse, which produced a vaccine vesicle in the human subject identical in appearance with the cowpox, and which gave an equal protection against the smallpox, as was proven by the test of variolous inoculation.

The early tests of the completeness of the prophylactic power of variola vaccina against variolous contagion seemed to justify the sanguine expectations of the profession and the public, but time has fully verified the correctness of Jenner's first impression, that it gave the same protection that variola itself gave, and no more.

The practice was promptly adopted in all civilized countries, and even introduced among the heathen and the savage races of men, and has been, under Providence, the means of preventing more suffering and prolonging more human lives than any invention or improvement in the history of the world.

Jenner gave specific directions to guide operators in distinguishing the true protective vaccine vesicle from the spurious, the time when the lymph should be taken for propagating the disease, how to preserve it fresh for use, the mode of operating, and the characteristics which it is essential for it to present upon the different days of development, maturation, and decline, in order to impart to the system its full prophylactic power. The operation of introducing the matter is so simple that it has encouraged a large and promiscuous domestic practice, in many of which cases it is feared the conditions essential to giving a constitutional protection have been absent, so that no reliable security against variola has been obtained. The opinion widely prevails with the people that the only evidence required of a successful vaccination is the production of a sore upon the arm, and the more inflamed it becomes, the more convinced are they that their protection is complete. Experience in the practice, and the increasing frequency of variolous attacks after vaccination, reputed and real, have shown the folly of intrusting the practice to the inexperienced, and demonstrates the necessity of paying strict attention to all the directions laid down by Jenner and later vaccinators.

I deem it unnecessary to produce authorities to prove how complete an exemption is obtained, at least for a time, by a constitutional vaccine impression. That its prophylaxis is more complete at first, and diminishes by lapse of time, is sufficiently proven by the fact that, in the great smallpox hospitals, both in Europe and America, scarcely an instance occurs of a person under ten years of age, who bears evidence of having been properly vaccinated in infancy, and a death from variola, after recent and complete constitutional vaccination, is a thing almost unheard of.

Many of the European governments took measures, immediately after the character and reliability of vaccination were established, to make the practice general and compulsory throughout their territories. The wisdom and foresight of this policy have been fully demonstrated, for an epidemic smallpox, of any severity, has not occurred in Austria or Prussia for the last fifty years. And although the British government was fully satisfied of the value of the vaccine prophylactic in the preservation of human life, no measures were taken to make it compulsory, or to forbid variolous inoculation, until 1840. In 1853 an Act of Parliament was passed making it a penal offence for any British subject to fail to protect himself by vaccination.

The first year after the passage of this law making it a penal offence to neglect vaccination, the number in Great Britain who sought protection from it more than doubled, and the mortality and decumbents from smallpox proportionately decreased. From an imperfection in the law not naming the officer whose duty it was to enforce the penalty, the practice in a few years lapsed into neglect, but recent amendments to the act have made it efficient, so that it is now working satisfactorily, and will, if faithfully executed, give the nation almost entire security from smallpox.

There may be some diversity of opinion as to the steps proper and necessary to be taken to secure every individual in society the full protection which a successful vaccination gives against variola, though to our minds it is clearly a question to be settled by our legislators, upon the principle that it is their duty to secure the greatest good to the greatest number. In this particular instance, all would be benefited and none injured. With us the belief had become prevalent that the temper of the American people would not tolerate any interference on the part of government in matters of a purely personal and domestic character. The experience of the last few years, however, shows us to be as submissive to the will of rulers and governments as any people on earth. There is not only wisdom, but a necessity for a people loving liberty and cherishing independence, to guard with jealous care every encroachment upon their political rights and constitutional privileges; but it is believed that similar reasons would not be urged or found pertinent against hygienic measures which aim to secure the health of the individual, while equally protecting that of the whole community.

The fact is conceded on all hands that the true vaccine disease, which is in all cases perfectly harmless, does, for a limited time, give almost perfect security against the contagion of variola. This being true, it is not only the interest of the individual, but the duty of the government, that such measures should be enforced as will secure vaccine protection to every member of society. For the deduction is irresistible, that if vaccination does possess the prophylactic powers claimed, smallpox only exists among us in consequence of the neglect to apply the preventive. Every person, who is at all familiar with the laws relating to public health, in large cities and throughout the States, knows, that as regards protection from smallpox, they are utterly inefficient and delusive. We therefore conceive that the government can no longer in justice ignore the fact that means exist, and are at their disposal, of saving annually in the United States the lives of forty or fifty thousand persons from death by smallpox, and of protecting double that number from lengthened suffering, deformity, and mutilation.

The medical profession is unanimous in the belief that the universal application of the vaccine prophylactic, and the repetition of it at proper intervals of time, will ultimately exterminate the smallpox from among us, or render it entirely harmless. This belief is not founded upon theory alone, but upon the experience and accumulated evidences of its power, gained by practice and observation during nearly three-quarters of a century.

If the legislative and corporate authorities of our country believe the facts here set forth—and, if doubted, they can be overwhelmingly substantiated—it is manifestly their duty to inaugurate measures to secure effective vaccine protection to every person, without distinction, residing within the sphere of their authority. Indeed it is not creditable to the intelligence nor humanity of our rulers, nor to the influence which the medical profession should exert, that smallpox has been permitted to tarry so long among us, slaying its victims almost without hindrance, when an almost certain and safe preventive is within the easy reach of all.

The doctor who has vaccinated a family with pure Jennerian vaccine lymph, taken at a proper time from a fit subject, and has watched its passage through the various stages of its development and impression upon the system, and observed that it is regular in every particular, according to the rules and type laid down by

Jenner and others, and then tested the security which they have obtained by the reintroduction of fresh vaccine lymph, feels as confident of their safety from an attack of variola as he can of anything in the future.

An example of the promptness and efficiency with which vaccination, when universally applied to a class or a community, can arrest and control the spread of variola, even in the midst of a severe epidemic, was recently given in the city of Washington. Sporadic cases of smallpox began to manifest themselves among the troops in their camps shortly after their arrival here in 1861. The contagion finally extended to the resident and floating population, and for two years prevailed as an epidemic.

The corporate authorities directed their ward physicians to vaccinate, free of cost, all who would call for that purpose, and the profession generally exerted their influence to have every person vaccinated or revaccinated, so as to be in a known state of vaccine protection. In January, 1864, after the disease had been prevailing for over two years, the metropolitan police took a careful census of all the persons unprotected by vaccination from variola, and they were found to amount to about one-sixth of the resident population.

During the period of the prevalence of variola, the colored population was largely increased in the District of Columbia, in consequence of their liberation by the progress of war, and the emancipation acts, and it was among them that the example of the prompt arrest of the smallpox alluded to was effected. The disease, as was to be expected, extended from the soldiers and citizens to the "contrabands" collected for safe-keeping within the city and crowded into camps during the early period of the war. Fortunately for these colored people, the military control under which they were held, enabled the surgeons in charge to have them all freshly vaccinated, and to take other necessary measures to control the contagion. This general vaccination promptly and effectually broke the force of the epidemic among them. A few cases only occurred afterward, and they were chiefly among new arrivals and those who had found temporary employment in the neighborhood, and thereby escaped the vaccination. The protection so promptly secured for this unfortunate class of persons under such unfavorable circumstances, can be readily gained for all others more favored with the comforts of life, if the means be judiciously used.

Vaccination is compulsory in the American and all European armies, which is, no doubt, the secret of their exemption from variolous epidemics. It is a rare thing for the old soldier who has been repeatedly vaccinated to be the victim of smallpox. New recruits, camp followers, and the denizens of cities and towns in and around which armies are encamped, are most likely to be the sufferers, because they are under no compulsion to protect themselves by vaccination or revaccination.

So confident are military commanders of their ability, by timely vaccination and revaccination, to prevent the smallpox from becoming troublesome among their troops, that it is made a standing regulation for all recruits to be vaccinated on entering the service. And should variola break out and prevail to any considerable extent in a division of the army, it is taken as an evidence that the surgeons in charge have neglected their duty. When the difficulty becomes serious, charges are preferred against the surgeon, and if the facts do not contradict the presumptive neglect of vaccination, he is dismissed the service.

It is as much the duty of our civil rulers to protect the health of the citizens over whom they are appointed to preside, as it is for military commanders to preserve the strength and efficiency of their armies. Health is no less important to the prosperity of communities at large than it is to the success of our army.

A practice, that has proved successful in protecting large bodies of moving troops throughout all their departments, can be made equally efficient in protecting every member of society. The experience, which has been gained on the subject of vaccination and revaccination, and its prophylactic efficacy when recently performed, warrant the profession in entertaining the confident belief that variola can be annihilated, or rendered harmless, if the authorities will enforce universal vaccination. The individual who is not protected from smallpox by vaccination, or who has not had that disease, is in a condition liable on the slightest exposure to be attacked, and thus become the centre and source of spreading a loathsome malady which may destroy the lives of others. The question of the prophylactic power and safety of vaccination is so well settled that the individual, who fails to protect himself against variola by it, should be looked upon by the community with aversion, and treated as a nuisance (as he really is, so far as the social interests are concerned), and be compelled to submit to vaccination for his own safety and the protection of the public.

Parents and guardians have no more right to withhold or neglect to provide vaccination for the children under their protection than they have to jeopard the lives of these helpless infants by not furnishing them with food or clothing. It is criminal to neglect either, as death may be the consequence, but the failure to provide protection against the smallpox seems to be more maliciously wicked than to neglect either food or clothing, as the former may not only cause the death of the child, but be the means of spreading disease and death among many others, while the evil which arises from the latter ceases with the death of the victim.

The neglect, or almost criminal delay and indifference of many persons to vaccinate those dependent upon them, renders the interference of the civil authorities in the matter just and necessary, and it is therefore conceived that no person can with any degree of justice complain of the establishment of a regulation, general in its application, which will secure protection from the smallpox to all. A compulsory mode is the only one that will ever secure protection to those whose indifference or prejudice causes them to neglect themselves, and thereby endanger the safety of the communities in which they reside.

The right is almost universally conceded to belong to all legislative and corporate authorities to restrain, under proper regulations and for the public good, those who may be suffering from contagious diseases, the insane, and those who are evil disposed to their neighbors. All sanitary measures are founded upon the principle that the well have the right to impose such restrictions upon those sick of contagious disease, as experience has demonstrated will control its spread and protect the community. Smallpox hospitals should be supported by cities, to which every case occurring in crowded houses and thickly populated neighborhoods ought to be promptly removed, if possible. All persons attacked with variola who have neglected to comply with such regulations as the corporate authorities may have directed for the protection of the individual, and for public security, should unquestionably be removed to the hospital, so that they may no further endanger the health of the community. But how much more wisdom there would be in a government forestalling by timely legislation the spread of a preventible disease, dangerous to life, than in waiting until it becomes epidemic, and then be compelled to resort to harsh and distasteful measures to restrict or extirpate it. To accomplish the prevention of smallpox is a desideratum of the highest importance, and to this end we ask for the adoption of no new principle in hygienic legislation; but we do ask for the efficient application of those powers which it is incumbent on all custodians of the public health to exercise with enlightened judgment. We insist that the intelligence of the age and the security of public health demand that the legislative authorities should abandon the policy, which has ruled for years, of taking no action in regard to vaccination—in itself a mistake, if not a crime, and which is costing the country annually the loss of from forty to fifty thousand lives—and at once adopt a mode more in harmony with the spirit and requirements of the times, and eminently democratic, as it only exacts of the few a temporary sacrifice of convenience for the permanent benefit of all.

We believe that the universal application of the vaccine prophylactic at an early period of life, and its repetition at proper periods, will ultimately exterminate the smallpox, or render it of very rare occurrence.

The regulation adopted by some school boards, of requiring children to produce evidence of their having been vaccinated before they are permitted to attend the public schools, is a wise and proper precaution. But the measure is partial, and does not go far enough to effect its purpose. The regulation should be made to embrace every member of the family, and all the inmates of the house from which the children come. The parents of scholars and others residing with them may be unprotected from smallpox, or the disease may actually be at the time in their house, yet the children attending school may escape the infection by virtue of the completeness of their vaccine protection, though they may carry it with them to school and give it to others less perfectly protected, either from original defect in the operation, or become so by lapse of time. All colleges, private schools, and institutions of learning ought to adopt the same regulation, and require vaccination as a condition precedent to admission.

If public opinion gives its sanction to the compulsory vaccination of those attending free schools, and the plan has worked to the interest of the individual and the public, I can see no good reason for not extending the principle so as to embrace the whole community. No school can be safe from variola for any considerable length of time, so long as the majority of the people of the district, from which the scholars come, remain unprotected. It is the duty of our rulers, and those responsible for public measures, to protect every member of society from preventible sickness; and we can see no excuse or justification for not making a special provision of a compulsory character in a measure of such utility and general beneficence as vaccination is conceded to be.

It is believed that intelligent public opinion is prepared to second, by efforts of a legislative character, measures to secure the general application of the vaccine prophylactic to every citizen; and it is confidently believed, that, if the practice be faithfully carried out with this spirit, it will almost eradicate variola, and will yearly save to the country thousands of valuable lives. The necessity for infantile vaccination is almost universally conceded, yet conviction is by no means so general in favor of secondary vaccination. But the profession believe revaccination to be nearly as essential to the continued protection of the individual and the safety of the community as the primary. This opinion may seem ultra to some, but the position is fully sustained by the extended and accurate observations made in the European armies, and the voluminous statistics collected and condensed in the report of the Committee of the American Medical Association upon "Compulsory Vaccination."

That the protection gained by vaccination against variola is not in all cases permanent, is too evident to require proof in this place. And that cases of variola occur more frequently after the lapse of a second series of five years from the time of vaccination than during the first, is substantiated by the observation of every physician in general practice, and particularly by the reports from smallpox hospitals.

There are a few persons, estimated at from one to two in the thousand, who are not susceptible to the influence of the vaccine disease, and who are equally exempt from the infection of variola. This small class of persons seem neither to be liable to the disease themselves, nor do they act as mediums to convey it to others. There are also a few, about eight in the hundred, who never lose the protection gained by a complete vaccine impression in infancy. It must, therefore, be apparent to the most indifferent observer that the chances of escape from the casual smallpox are too few to decline vaccination, and even too uncertain to justify an objection to revaccination. The mortality attending a given number of cases of casual smallpox is as great at the present day as it probably ever was, ranging steadily at about one death in every five or six attacked, while not one death occurs in a thousand who are seized after recent vaccination. These facts show, as conclusively as anything possibly can, the propriety and necessity of vaccination and revaccination.

The theory, which obtained with the profession at the period when vaccination was introduced, was that smallpox never attacked the same person a second time. The exemptions from second seizures are certainly of noticeable frequency, but are by no means invariable. The proportion of second attacks is variously estimated at from 1 in 250 to 1 in 10,000.

All the early experiments to test the prophylactic powers of vaccination were made upon persons recently vaccinated with matter that had passed through but few systems, or upon those who had the disease directly from the cow ; and, as they resisted variolous inoculation, it was hastily assumed that the exemption was complete and permanent in all. The experiments of the first few years seemed to warrant this mistaken conclusion, and it is now a strong argument in favor of the diminishing powers of the vaccine protection, as well as in favor of matter recently derived from the cow, that scarcely any cases were attacked with variola for more than ten years after the discovery of vaccination. The evidence upon which the permanency of the prophylactic power of vaccination has been impeached, has been closely scanned by the profession, and reluctantly conceded to be conclusive.

It was for a long time apprehended that the fault or failure of protection after vaccination was in the quality of the matter used in propagating it, or from some accident to the vaccine vesicle during its course. The statement was made by Jenner, and is well known by the profession to be correct, that but slight variation from the normal course in the development of the vesicle will prevent it from giving that constitutional impression which is essential to complete protection. Others held that the cowpox was an antidote to the smallpox, destroying or changing in some manner the cell formation in which the latter has its origin, and that when this is completely accomplished by a single or repeated introduction of vaccine virus, the patient forever after remains proof against variola. The quality of the vaccine lymph used, the mode of introducing it, the number of vesicles essential to protection, and their characteristic appearance, have all been closely scrutinized, with the hope of finding the cause of failure in the mode of practice, and not in the nature of the vaccine itself. As nothing essentially wrong could be discovered in the mode of practice, another question arose as to whether vaccine matter lost anything of its prophylactic powers in passing for years through the systems of great numbers of persons. This question was investigated by both the British and the French national vaccine boards, on behalf of their governments, and it was decided, after comparative tests on their part of lymph fresh from the cow and of that which had for years been passing through the systems of individuals, that they presented no appreciable difference. Later investigators in each of these countries have modified these opinions, and similar boards have recommended an occasional return to the original source for supplies of genuine matter for propagating vaccina.

Nearly all early investigations as to the durability of the vaccine protection were made upon the presumption that there is no tendency in the system to repossess itself of the elements which render it liable to variola. The fact was not remembered or conceded in argument that even the confluent smallpox did not always confer permanent protection against future attacks. If patients confined to the infectious atmosphere of smallpox hospitals were occasionally to be seized with relapses soon after a first recovery, instead of being attacked, as is usual in such cases, many years later, and often without a knowledge of the source of the contagion, we should be inclined to regard with some favor the theory of incomplete exhaustion of the variolous elements. Considerations of the kind named warrant the belief that the system in time regains either partially or entirely its receptivity to variola, which had been enfeebled, not destroyed, by the attack, whether of the casual or induced variola, or by vaccination itself. But we conceive that by far the most frequent cause of second attacks of variola and of smallpox, after vaccination, to be that the system regains by lapse of time those elements, temporarily exhausted, which render the system liable to variola. This proceeding is in accordance with a general physiological law governing the recuperation of all organized bodies, which is to repair their injuries and recover strength and return to their normal state as speedily as possible. And susceptibility to variola is a condition common to the whole human family.

The period of time which so weakens the protection temporarily gained, whether from the casual or the inoculated smallpox, or from vaccination, leaving the system again liable to smallpox, cannot be definitely stated, and is perhaps controlled in each individual by some constitutional peculiarity. And as the duration of the protection gained from variola by vaccination cannot be definitely determined, the safety of the individual and the community requires that vaccination be begun in early infancy, repeated in childhood, and again had recourse to about the period of puberty, and perhaps still again later in life, to retain the system in a state of complete prophylaxis.

A spirit of distrust in the protective power of vaccina over variola immediately began to manifest itself among the people when they found that it was not permanent in its effect. This distrust has unfortunately acquired such an influence as to well nigh produce that condition of non-protection, from which epidemic smallpox may at any time break out and prevail with its wonted frightful mortality. The recommendation of the profession to supply from time to time the exhausted vaccine prophylactic by revaccination is often refused by the people, and, it is to be regretted, is thought to be unnecessary by some of the medical faculty.

Vaccinators, who have had much experience in the use of lymph taken directly from the cow, assure us that it produces greater constitutional disturbances, and more severe local effects than matter taken from the human subject, many removes from its original source. This being true, it ought to settle the question in favor of returning frequently to the original source, so as to be sure of having matter of the highest known protective power. How many years it may be used, and through how many individuals it may pass, and yet impart protection against variola, I will not attempt to decide. The belief is warranted by experience that vaccina loses something of its vigor and perfection, though retaining its chief external characteristics, and gives protection to a less degree the further it is removed from the original source.

The State of Maryland has a judicious law upon this subject, which requires that "all vaccinations are to be performed with matter not more than four removes from the cow." There is maintained at Naples an establishment, founded over fifty years ago by M. Galbiati, for propagating the cowpox among heifers, with a view to keep up a perpetual supply for the use of the profession. When vesicles have arrived at a proper state to convey the protective disease, the animal is driven around from door to door of those desiring to be vaccinated with the lymph directly from the cow. The royal family and nobility patronize this method, and all who are able to afford the expense prefer it to the ordinary method, which is cheaper.

European practitioners prefer the method, originally recommended by Jenner, of using lymph fresh from the vesicle in vaccination. It is to be regretted that in the United States the crust has been almost entirely substituted for the lymph in propagating the disease.

Of late there has been much said through the public press and medical journals of other diseases having been conveyed through the inadvertence of the operator using impure vaccine matter. No facts have come to my notice that authorize this statement. Where the crust is used, such an untoward result is possible, and the public deserve to be protected against the possibility of danger through this source, and therefore the legislative and corporate authorities ought to make provision for furnishing the profession with an adequate supply of pure vaccine directly from the cow. The government should assume to furnish the profession, for the good of her citizens, with pure liquid vaccine lymph; and at no very distant day the matter that has been circulating for half a century through a multitude of human systems, and taken after it has dried into a crust, ought to be discountenanced by the profession, if not prohibited by law.

The profession must bear in mind that there is a spurious as well as a genuine vaccine disease—the one giving no protection against smallpox, and the other securing almost complete exemption. The genuine disease may, from slight causes, degenerate into the spurious, giving no constitutional protection whatever; therefore its entire course ought to be watched, and where there is the slightest deviation from the natural, the operation ought to be repeated. We believe there is no greater difficulty in distinguishing the true Jennerian vaccine disease, the lymph of which will protect the system, and is suitable for propagating the protective disease, from the spurious and unreliable, than there is in diagnosing correctly, scarlet fever from measles, or measles from smallpox. But to determine whether a crust contains genuine or spurious vaccine elements, or the seeds of other diseases, is more difficult, if not utterly impossible, unless where you can learn its exact history during every stage of its progress. The true Jennerian vaccine vesicle, from the fifth to the eighth day inclusive, or while the lymph secretion remains clear and transparent, and before the areola forms around it, can yield nothing but genuine vaccine virus. This, too, is the only period of the vaccine disease and condition of the vaccine vesicle from which reliable matter can be taken, or that will produce a full protective constitutional impression. The certainty with which we can determine the character of the vaccine disease in its vesicular state, and the facility with which it can be propagated from matter taken at this period, makes it the most favorable time for these purposes. The smallest portion of lymph in a fluid state is sufficient to produce the desired effect, and will not fail once in a hundred times, and is therefore much to be preferred to the best dried lymph or crust when we desire to produce an immediate vaccine impression. When lymph is used directly from the arm, the danger of introducing spurious vaccine matter and other diseases is reduced to its minimum; indeed it is rendered almost an impossibility, as the characteristics which distinguish the true Jennerian vaccine vesicles from the spurious, at this stage, are so well defined that it would be inexcusable for any doctor to mistake them.

It is worthy of remark that a vaccine vesicle of the most perfect character may, on the fifth, sixth, or even seventh day, and even after we have extracted reliable lymph, develop an unhealthy action, which will endanger or defeat protection to the individual, and render the remaining matter unfit for propagating the vaccine. A true Jennerian vesicle, running an entirely regular course, connects with its specific vaccine secretion in drying matters, the product of ulcerative action in the surface layers of the skin. Of course, when the crust is used for propagating the vaccine protection, these different elements cannot be distinguished or separated. Even when we have the finest translucent mahogany-colored crust, it is only the central part that is fit for use, as the lower layer and edge contains, of necessity, these foreign matters. It is notorious that the matter which occasionally exudes from a vaccine crust in process of drying, and which has been regular in every other respect, will excite, if introduced into another person, a pustular inflammation, of considerable severity, at the point of insertion, but without the characteristic vaccine vesicle, and therefore gives no protection against variola. If it were not for the difficulty of preserving or obtaining the fluid lymph when wanted, the crusts, I am quite confident, never would be used by the profession.

I venture to add that no vaccine crust ought to be relied upon for propagating vaccine which the doctor has not watched throughout its various stages of development, maturation, and decline, and of the genuineness of which he is not satisfied. He ought to know that there was at no time the least undue inflammatory or ulcerative action, that the vesicles appeared at the proper time, and presented the usual form and appearance; that they contained an abundant secretion of the pearly lymph characteristic of the genuine cowpox; that they remained unbroken and unchanged in color from the fifth to the eighth day before the areola began to form around them; and that the lymph dried up and did not exude from the vesicle; in a word, he ought to be satisfied that the crusts contain the elementary cells essential for propagating a disease preventive of smallpox, and nothing else.

After a pretty full examination of the subject of vaccination, and the best modes of obtaining protection from smallpox, I feel called upon to urge the profession of the United States to adopt the use of the fresh lymph exclusively in vaccinating. I am satisfied that by this method, fewer failures to produce the necessary vaccine impression will occur, and that, at the same time, the quality of the protection will be improved. The modes which have been adopted in Europe for preserving the lymph for a short time, and transmitting it from place to place, is between small pieces of flat glass and upon ivory and quill points, and in Husband's capillary glass tubes. There is, however, no mode of vaccination superior or equal, when it can be arranged, to that of having the person from whom we are to extract the lymph, and the one to be vaccinated, brought to the same house, and then to transfer the vaccine fluid upon the same lancet with which we give it a lodgment in the new patient. In the private practice of physicians in cities and towns there ought to be no difficulty in propagating vaccination in this way. With country practitioners this mode of proceeding will be more difficult of accomplishment; but when the patients cannot be brought together, the lymph should be conveyed and used in a fresh and fluid state.

The mode of introducing the vaccine lymph is not a matter of such entire indifference as is usually supposed. In Europe it is held to be a matter of so much importance that instructions are issued yearly from a central vaccine board to all vaccinators throughout the country, instructing them upon this and other points essential to the success of the practice. The plan I prefer, and generally practise, is by a simple puncture. This I make with an ordinary thumb lancet, introducing the point quite flatly under the scarfskin of the arm, though so superficially as to scarcely draw blood. A similar puncture is made in three several distinct places in each arm, an inch and a half to two inches apart. Having introduced the lymph of a proper character from a healthy subject, the punctures are left without dressing. From this mode there results less ulcerative action than when the skin is scarified by a number of transverse incisions, and the papular and resulting vesicles are more regular in form and less likely to be the seat of undue inflammatory action, which, by other modes, not unfrequently prevents vaccine protection.

When this mode of multiplying the vaccine vesicles—which is, in all essentials, the one recommended and adopted in England—has been practised, and good-sized vaccine vesicles have formed at all the points, the physician need have no hesitation in extracting lymph from as many as two or three for the purpose of conveying the prophylactic to others; or should the secretion in two or three of them be destroyed by accident, no apprehension need be experienced, as those remaining will furnish lymph in abundance. I consider it highly important to a complete constitutional saturation with the vaccine element, that at least six good-sized vesicles be obtained in every case. And I consider it equally important that at least three of them should be preserved undisturbed for the action of the absorbents, as less than this number gives but unsatisfactory protection against variola. When, from any accident, all the vesicles get destroyed before the tenth day, the vaccination ought to be repeated, lest a complete constitutional impression may not have been obtained.

The operator must not lose sight of the fact, that constitutional vaccine protection is obtained from the absorption of the specific vaccine secretion, which takes place in each successful case, and not from the matter originally introduced. For instance, if genuine vaccine lymph be inserted into the arm, a perfect vaccine vesicle forms on the fifth day, but if destroyed on the sixth, or before absorption of the vaccine lymph has taken place, no constitutional impression will result. Here the developing process is aborted, and the germ destroyed, so that no more specific secretion can take place, as we have all seen frequently exemplified in the early destruction of a venereal pustule or chancre, which, if done early, effectually prevents its specific constitutional effects. The evidence that absorption of the protective vaccine element has taken place is the establishment of a deep-red areola, extending for an inch or more around the vesicle. But the only reliable evidence we can have that complete vaccine protection has been obtained is by the introduction of fresh vaccine matter.

The importance of producing and preserving two or more vaccine vesicles in each case has been thoroughly investigated in Great Britain, where vaccinators are specially directed to obtain not less than from four to six distinct and perfect vesicles.

Mr. Marston, whose experience in smallpox is scarcely equalled by any living practitioner, prepared for Mr. Simon, of the Privy Council, the following information upon this point—the evidence of security or danger to be inferred from the character and number of vaccine cicatrices, derived from data covering six thousand cases of post-vaccinal smallpox, and running through twenty-five years of service in a large smallpox hospital. The facts were tabulated by Mr. Simons, and will be found on page 25 of his *Report on Public Health in Great Britain*, for 1860.

The facts collected by Mr. Marston's industry are so conclusive upon the point under discussion that I am moved to reproduce them here, merely making a slight alteration in the order in which they first appeared and somewhat condensing them.

"*Comparative ratio in which persons vaccinated in different ways will be safe against death from smallpox should they be attacked by it; also the rate of mortality attending the unvaccinated. Cases classified according to number and character of vaccine marks.*

	Deaths per cent.
1. Stated to have been vaccinated, but having no cicatrix	$21\frac{3}{4}$
2. Having *one* vaccine cicatrix (*a*)	$07\frac{1}{2}$
3. Having *two* vaccine cicatrices (*b*)	$04\frac{1}{8}$
4. Having *three* vaccine cicatrices	$01\frac{3}{4}$
5. Having four or more vaccine cicatrices	$00\frac{3}{4}$
The unvaccinated	$35\frac{1}{2}$

(*a*) Among cases in which the one cicatrix was well marked, the death rate was $4\frac{1}{2}$; among cases in which it was badly marked the death-rate was 12.

(*b*) Among cases in which the two cicatrices were well marked, the death-rate was $2\frac{3}{4}$; among cases in which they were badly marked it was $7\frac{1}{4}$."

Thus it will be perceived that among those attacked with smallpox, reported to have been vaccinated, but upon whom no vaccine cicatrix can be observed, about one-fifth die. In those who present one good, well-defined, vaccine cicatrix, only four per cent. die; but when the scar is indistinct, the percentage of mortality rose to twelve in the hundred. When cases presented two well-defined vaccine cicatrices, the deaths scarcely reached three in the hundred; but when there were two, and they but slight, the percentage of mortality rose to seven. In every hundred cases occurring in persons who had three well-marked cicatrices, the average mortality fell below two per cent.; when there were four or more good cicatrices, the percentage of deaths from smallpox did not amount to one in the hundred.

These facts are as pointed and conclusive in favor of four or more vesicles as can be wished, and ought to revolutionize the practice of vaccination, as ordinarily conducted in the United States. We seldom produce more than one vesicle, and use almost exclusively the crust which is acknowledged to be inferior to the lymph in propagating vaccine. In Europe, the opinion prevails very generally that one vaccine vesicle cannot be relied upon as affording complete protection against variola. If Mr. Marston's facts are correct, they go far to explain why varioloid is more common and more fatal in the United States than elsewhere; and applying these facts to our own country, it forces us to the inevitable deduction that not fewer than seven, in every hundred persons vaccinated in the mode common with us, are liable to death if attacked by variola. But by inducing, in all cases, from four to six good-sized vaccine vesicles, the liability to death from variola is reduced to less than one per cent. While we regret that the protection in those who have been vaccinated is not as complete as we could wish, yet we have still more to regret that at least one-tenth of our whole population remains without any protection at all, and among them, if attacked with smallpox, from twenty-five to thirty-five deaths in the hundred would occur. We feel impelled, in view of all these facts, to warn the government and the profession of the danger to public health from the want of proper vaccine protection, which has not been and could not well be overstated.

The remaining vaccine cicatrix, although of considerable importance when it is of regular form and of distinct characteristic appearance, cannot still be relied upon as giving a true indication of the degree of vaccine protection the individual may be under at the time. Constitutional peculiarities, with the lapse of time, so restore the receptivity to variola to some individuals, that it is not uncommon for persons having deep scars from casual smallpox, and others bearing satisfactory and typical vaccine cicatrices, to become the victims of fatal attacks of the disease. Therefore, when there is a wide-spread tendency to variola, the doctor should give his patients the benefit of the absolute test, by the introduction of fresh vaccine lymph, unless they have undergone a successful vaccination within five years.

That fresh lymph from a true Jennerian vaccine vesicle has been introduced into the arm of a patient in the mode recommended, ought not of itself to satisfy the doctor that exemption against variola has been secured. Failures to protect, even when the purest vaccine lymph has been used, are not unfrequent; and it is the vaccinator's duty to detect and remedy any defects. It is as unpardonable for a doctor to fail to protect his patient from smallpox by proper vaccination, as would be any other species of malpractice.

It is the duty of the vaccinator to see that the vaccine runs a regular course, forming on the second day a slight elevation, felt on pressure, and showing, by the aid of a magnifying glass, some redness on the third, and forming a thin transparent vesicle, exceeding the point of insertion on the fifth, elevated at the circumference and depressed somewhat at the centre. The protective vesicle fills with a clear pellucid fluid, which should remain unchanged in color until the eighth day, at which time it attains its highest perfection—is oval in form, and of a beautiful pearl color. At the close of the eighth day the inflamed ring or areola begins to form around the base of the vesicle, extending from one inch and a half to two inches in circumference, causing considerable hardness and swelling of the cellular tissue, reaching its height about the tenth day. During these two days there is generally some constitutional disturbance noticeable, and the glands under the arms usually give evidence that active absorption has been going on. The vesicle, which has gradually become opaque after the eighth day, on the twelfth begins to concrete, and by the fifteenth is formed into a fine crust or scab, which usually falls off by the twenty-first. The success in giving vaccine protection depends chiefly upon the regularity, quantity, and quality of the true Jennerian vaccine secretion, left to the undisturbed action of the absorbents.

The age of the individual does not seem to exercise any perceptible influence over the degree of protection gained. The uniform mildness of the disease justifies the practice at any age and at any season. Prudence, however, suggests to the physician to vaccinate infants between the first and the fourth month, or before teething has commenced. I have, on three several occasions, when there was smallpox in the house, and when exposure could not be avoided, vaccinated the infant immediately after it was washed and dressed. In no instance did this prove unfavorable to the health of the child, nor did the vaccina deviate in the slightest degree from the regular course. With ordinary care, the season of the year, as I have intimated, will exercise no unfavorable influence upon the production of the true vaccine impression. The amount of clothing worn in this climate in the winter season, from its weight and friction, endangers somewhat the safety of the vaccine vesicles, and to the extreme heat of summer there is also some objection, from the profusion and irritating effects of perspiration, which sometimes induces inflammatory action, destroying thereby the specific and protective character of the vaccine secretion before it has been absorbed or has produced its constitutional impression.

When, however, the circumstances of parents are such that these slightly embarrassing conditions can be watched and controlled, the operation need not be delayed on account of the season.